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# The ideological alignment of smart urbanism in Singapore: Critical reflections on a political paradox

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# The ideological alignment of smart urbanism in Singapore: Critical reflections on a political paradox

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Abstract

Over the past decade, much has been written about the potential of smart urbanism to bring about various and lasting forms of betterment. The embedding of digital technologies within urban infrastructures has been well documented, and the efficiencies of smart models of urban governance and management have been lauded. More recently, however, the discourse has been labelled 'hegemonic', and accused of developing a view of smart technology that is blinkered by its failure to critique its socio-political effects. By focusing on the case of Singapore's 'Smart Nation' initiative, this paper embraces the paradoxes at the heart of smart urbanism and, in doing so, interrogates the tension between ideology and praxis, efficiency and control, access and choice, and smart governance and smart citizenship. It also demonstrates how such tensions are (re)produced through 'fourthspace' – the digitally enabled spaces of urbanism that are co-created, and that contribute to an expansion and diffusion of social and political responsibility. It ends by suggesting how such spaces have the potential to radically transform not just the urban environment, but also the role of government and citizens in designing urban futures.

Keywords

Governance, Singapore, smart nation, smart urbanism, urban futures, urban infrastructures,

## Introduction

Over the past five years, as urban planners around the world have become more vocal in their advocacy for, and uptake of, smart technologies, so urban scholarship has begun to explore the transformative potential of such a trend. The smart urbanism paradigm presents the latest incarnation in the 'history of urban imaginaries' (Vanolo, 2014: 885; see also Kitchin, 2014, for the evolution of terminology), and has been embraced as a panacea for urban environments around the world. The 'smart' prefix suggests a utopic antidote to the oft-dystopic urban form. Smart urbanism has accordingly been described as a 'techno-utopia' (Luque-Ayala et al., 2014), an 'en vogue label' (Vuolteenaho et al., 2015: 2), a 'seductive and normative vision of the future' (Luque-Ayala and Marvin, 2015: 2105), a 'silver bullet for urban problems and a major market opportunity' (Buck and While, 2017: 501), and 'a potent brew of associations, images and connotations' (Wiig and Wyly, 2016: 485). In its more applied form, smart urbanism is simply an urban response to the explosive growth in the production (and potential) of data brought about by the permeation of digital technologies throughout the world.

The promises of smart urbanism are great, as rationalisation has the potential to make processes of economic growth and the management of public services and resources more efficient, productive and sustainable. Yet such promises currently lack full validation in the real world, and so have been

interpreted as more a marketing label than a fully realised opportunity (Hollands, 2008; see also Firmino and Duarte, 2016; Vuolteenaho et al., 2015). Indeed, the most critical of scholars have criticised it for being 'a hollow urban imaginary in search of meaning' (Buck and While, 2017: 504; see also McFarlane, 2016). The problem, therefore, is that much of the discourse is based on abstraction. The 'smart' prefix is not an absolute category, but a signifier that is relative to the content in which it is applied. Indeed, the existing preoccupation with the technological underpinnings of smart urbanism have rendered the discourse technocratic, and built on the assumption that 'complex social situations can be disassembled into neatly defined problems that can be solved or optimised through computation' (Kitchin, 2014: 9; see also Morozov, 2013). Blinkered by such reductionistic and functionalist biases, scholarship has been criticised for embracing the solutions to the manifestations of urban problems, rather than addressing their root causes.

As it stands, smart urbanism is an embryonic (and technically complex) subfield that is still finding its academic feet. Hitherto divorced from the social, political and cultural domains to which it relates (Luque-Ayala and Marvin, 2015; Shelton et al., 2015), it has accordingly been described as 'non-ideological, commonsensical and pragmatic' (Kitchin, 2015: 131). Such views reveal the considerable gap that has emerged between smart urbanism as a concept in its abstract, and applied, forms.1 More critically attuned scholars reveal the irony that smart urbanism is 'far from apolitical and non-ideological' (Kitchin, 2015: 132), and accuse it of being a 'depoliticised project that largely plays out according to the terms of profit-maximising, multinational technology companies' (Shelton et al., 2015: 14). Thus, the danger is that the ideology of smart urbanism is as much about enhancing a city's competitiveness and cachet so as to attract social and economic capital investment, as it is about the improvement of urban environments and their inhabitants. To reconcile such a distinction, there have been growing calls for scholarship that is theoretically informed, application-focused and critical in outlook (Kitchin, 2014, 2015; Leszczynski, 2016; Luque-Ayala and Marvin, 2015; Shelton et al., 2015; Vanolo, 2014; Wiig and Wyly, 2016).

This paper is a response to such calls. By focusing on Singapore's 'Smart Nation' initiative, we unravel a series of paradoxes that lie at the heart of smart urbanism. In doing so, we separate the various actors, agencies and ideas that are embedded within the assumptions of smart urbanism, and explore how they can disrupt old, and/or bring about new geometries of power. To this end, we advance the conceptualisation of 'fourthspace' as an idealised vision of an urban future to which urban planners and policymakers may aspire and critical scholars find robust. Fourthspace is a framework for understanding the changing, increasingly digitally enabled, ways in which different stakeholders engage with the city, and for interpreting the new spatial forms and imaginations that emerge as a result. By reconciling the paradoxes that undermine existing understandings of smart urbanism, it can lead to greater ideological alignment amongst the various stakeholders implicated by the project of smart urbanism. Based on the three pillars of digital space, data are/and power, and participatory governance, the framework therefore serves an emancipatory purpose, as it reveals how smart urbanism can help enable more equitable access to, and a rebalancing of power within, the city.

In what follows, the first two sections examine the promises and premises of smart urbanism, the aim being to provide an overview and consolidated perspective on what scholarship has covered so far. The next two sections focus specifically on Singapore: first by introducing the praxis of smart urbanism in Singapore, then by critically interrogating the Smart Nation initiative through an exploration of four paradoxes – ideology/praxis, efficiency/control, access/choice and smart governance/smart citizenship – that underpin any smart urbanism initiative, and particularly, as these paradoxes play out in the Singapore context. The final section introduces the concept of fourthspace, and identifies its emancipatory potential.

## The promises of smart urbanism

Smart urbanism has become a normative aspiration for the urban future. In fact, it would appear to be an almost inescapable reality for urban environments around the world, the only difference among cities being the pace and the extent to which the transition occurs. To resist smart urbanism would be to deny the reality that digital technologies – and the data they produce – have become the traceable evidence of the socio-cultural worlds that we inhabit, of the economic value that is being created, and of the forms of governance, power and control to which we must adhere. The promises of smart urbanism are, therefore, as endless as they are aspirational, and as abstract as they are future-focused. The idea of smart urbanism is one of seemingly unlimited potential: 'it is a product of our imagination, and it is limited only by our imagination' (Ho, 2017a). Accordingly, such visions have served to productise the city, rendering it a marketable commodity that citizens – or consumers – are being persuaded to buy into. Such rhetorical noise is especially pronounced in the public domain, where:

> Cities are at the center of a smarter planet, IBM tells you. RFID [Radio Frequency IDentification] chips, sensors, smart cards, and the emerging 'Internet of Things' will deliver optimal speed, efficiency, and convenience, your local transit agency/privatized power utility/city government assures you. 'Many Smart Ideas. One Smart Nation' declares the Smart Nation Singapore strategy … India's Ministry of Urban Development recently selected Bloomberg Philanthropies as the official 'Knowledge Partner' to catalyze the Smart Cities Challenge, with its less-than-humble aspirations: 'Smart Cities Improve Lives'. (Wiig and Wyly, 2016: 485)

The hyperbolic, highly corporatised nature of such rhetoric is revealing in itself, as it reflects the need to 'sell' an idea to inhabitants in order for them to buy into it, and, therefore, to realise its success. This is an idea that we return to later. The promises of 'optimal speed, efficiency and convenience' reflect the convergence of goals around the universalising aim (and, assumed appeal) of being faster and better than everything that came before.

As such, smart technologies are discursively positioned as having the potential to ameliorate the gamut of urban maladies. They can resolve traffic congestion and pollution, improve logistical efficiency, boost productivity and economic competitiveness, promote more equitable access to services, empower citizens, encourage more transparent and participatory forms of governance, realise more sustainable environmental practices; the list goes on. A city's 'smartness' is indexed to its ability to efficiently and effectively 'rationalise the planning and management of cities' (Shelton et al., 2015: 13), or, in other words, to introduce automated feedback loops that both respond to, and learn from, various data. Smart technologies are therefore harnessed with a view to realising an 'efficient, technologically advanced, green and socially inclusive city' (Vanolo, 2014: 883) that maps 'smartness' across all the main facets of urban space: its economy, transport networks, governance, environment, housing and liveability, and inhabitants.

Importantly, the promises of smart urbanism go beyond the creation of greater ease, efficiency and value, but also include more collaborative forms of governance. The technocratic underpinnings of smart urbanism promise to suppress the role of politics in managing the provision of and equitable access to public services. Resource allocation will be optimised based on the irrefutable logic of data rather than the decisions of politicians, resulting in what has been termed a 'post-political' world of fairness and equality (Wiig and Wyly, 2016). Indeed, the success of smart urbanism is underpinned not just by the co-operation

of citizens, but also their collaboration in designing a mutually beneficial urban future. Doing so involves creating and realising the notion of a 'smart' citizen that is predicated on the notion of sharing. This involves both providing the inputs needed to power a smart city by sharing private data, and sharing the responsibility for the management and improvement of civil society with government and private-sector agencies.

Despite such promises, the reality is that smart urbanism represents a technocratic – and, therefore, a singular – vision of urban development that sits uneasily with pre-existing notions of neoliberal urbanism. Returning to the rhetoric used at the start of this section, the fact that the 'smart' signifier is so abstract – it is resolutely future-focused and all-encompassing in scope – renders it liable to (mis)appropriation for political means. The fact that it is 'basically an evocative slogan lacking a well defined conceptual core' means that 'proponents of the smart city are allowed to use the term in ways that support their own agendas' (Vanolo, 2014: 884), and to further a technocratically biased vision of urban futures. Building on this observation, Kitchin (2015: 132) describes it as a 'hegemonic discourse' that is used to further the interests of urban elites (see also Greenfield, 2013; Hollands, 2008). In order to provide a bulwark against such (mis)appropriations, we now explore what is needed for 'smartness' to be realised by focusing on the some of the key dynamics – or the premises – of smart urbanism.

## The premises of smart urbanism

The promises of smart urbanism can never be realised until its premises are met. Before such premises can be met, they first need to be identified. Below we identify and explore three themes that are critical to the successful working of any smart urbanism project: data-driven feedback loops, effective public–(public-)private partnerships and integrating urbanisms of the past, present and future. By examining each in turn, we identify some of the key factors that need to be taken into consideration when it comes to the praxis of smart urbanism.

### *Data-driven feedback loops*

If technology is the infrastructure that forms the backbone of smart urbanism, then data are the oxygen that brings the body – the smart city – to life (Leszczynski, 2016; Shelton et al., 2015). The success of any smart solution is predicated on the effective monitoring, management and regulation of what is happening (and associated questions of when, where and what is happening) within a city, and an associated response based on desired outcomes and past learnings. This requires real-time, automated feedback loops based on digital data sources. Accordingly, data are the 'everyware' (as distinct from 'hardware' and 'software') that makes a city 'knowable and controllable in new, more fine-grained, dynamic and interconnected ways' (Kitchin, 2014: 2; see also Greenfield, 2006; Hatuka and Toch, 2017; Ho, 2017b; Kitchin, 2011). Building on the principles of machine learning, predictive algorithms are being heralded by some as a means to bring about forms of 'anticipatory governance' (see Leszczynski, 2016) that have the potential to resolve urban problems before they even arise.

Whilst the value of digital data lies in their abundance, their predictive potential, and their capacity to neutralise or depoliticise discourse through its seemingly objective reflection of urban realities, there has been growing concern about how 'data are conceived, collected and legitimised for use in urban politics and policymaking' (Shelton et al., 2015: 22; after Wilson, 2011). An enduring problem is that data can obscure as much as they can illuminate. Assumptions of the neutrality of data must therefore be balanced against more critical engagement with how they can be 'manipulated and designed to achieve desired strategic outcomes' (Barns et al., 2017: 21). Specifically, this has involved examining how data encourage

technocratic forms of governance that can 'reinforce existing power geometries and social and spatial inequalities rather than eroding or reconfiguring them' (Ash et al., 2016: 7; see also Datta, 2015; Rose, 2017; Shelton et al., 2015). Thus, as the ability to monitor, track and measure encroaches into ever-more walks of life, power can increasingly become concentrated amongst those that have access to data, and the feedback loops that they drive. In addition, digital technologies have turned many urban environments into 'digital marketplaces' (McLean et al., 2016: 3247; see also Viitanen, 2013) for the private sector, causing aspects of everyday governance to become an increasingly privatised – and, therefore, corporatised – a phenomenon that runs the risk of potentially compromising its focus on public service. Combined, this underscores both the importance of data as the lifeblood of smart urbanism, and the potential for their manipulation.

### *Effective public–(public–)private partnerships*

Smart urbanism involves a transformation in the governance of cities. This involves a shift 'away from vertical, often government-controlled integration [of digital infrastructures], to environments involving a mix of multiple public, private and quasi-private entities that manage and govern urban infrastructural systems' (Barns et al., 2017: 20–21; see also Alizadeh et al., 2014). Many governments do not have the resources, capacity or technical skills needed to implement 'smart' solutions autonomously (a notable exception being Stockholm City Council – see below); hence, partnerships with the private sector are often required. More than ever before, successful urbanism is based on public sector agencies relinquishing control to the private sector – and to other public-sector agencies – in order to build smart infrastructures, implement smart solutions and bring about positive change. Indeed, as forms of smart urbanism become more embedded, so too will the roles and functions of the public and private sectors become increasingly blurred. In light of this, the alignment of objectives and recognition of interests within and between stakeholders is of paramount importance, and has created a new set of policy- and privacy-related challenges – such as who has access to, and use of private data, data security, and the normalisation of surveillance – that the academy is yet to fully grasp (Barns et al., 2017).

The alignment and co-operation of different stakeholders needed to implement, manage and maximise the value of digital infrastructures is unprecedented in the history of urban governance. The need for such alignment is complicated by the 'sharp contrast' (Barns et al., 2017: 25; after Shelton et al., 2015) between the universalising tendencies of technology firms, which are scaled globally (and therefore develop homogeneous technological solutions that do not take into consideration the particularities of place or context) and often have little investment in the cities themselves (beyond capital), and the localised nature of urban governance. Indeed, the 'hegemony' of smart urbanism is reflected in the ever-shifting rhetoric of corporate elites, such as IBM, Cisco, Oracle and Siemens, which is strategically (re)positioned (from, for example, the realisation of urban autocracy for governments to citizen empowerment) in order to 'silence or turn detractors and bring them into the fold while keeping their central mission of capital accumulation and technocratic governance intact' (Kitchin, 2015: 133; see also Kitchin, 2014). The implicit mismatch between the scales of operations (local versus global), the stakeholders involved (citizens versus shareholders), and the overarching remits (governance versus profit) of the public and private sectors caused the Stockholm City Council, for example, to develop their own infrastructure networks2 that are independent of private-sector involvement.

***Integrating urbanisms of the past, present and future***

Complementing the idea of alignment is that of integration. No pre-existing city has evolved to become a smart city; instead, smart infrastructure is imposed on what came before. Every city has pre-established ways in which its component parts – its governors, inhabitants, public and private service providers, and businesses – interact; smart urbanism does not necessarily replace such interactions, but augments them in various ways instead. Every city also has pre-established infrastructures that enable the functioning of the city, based on prior technologies and systems. Smart urbanism is, therefore, a superimposed project that interacts in different ways – and with differing degrees of success – with urban forms, ideas and politics of the past. As a result, 'smart city interventions are always the outcomes of, and awkwardly integrated into, existing social and spatial constellations or urban governance and the built environment' (Shelton et al., 2015: 14). Mapping smart infrastructures over pre-existing urban environments results in geographic variability – across both society and space – in the spread and penetration of urban smartness. As much as existing technological infrastructures need to be updated, complemented, and/or replaced, so too do citizens from all walks of life need to be socialised – both ideologically and technically – into new ways of being governed. And as much as the governed need to adapt, so too do governments need to transform their models of operation to suit their cities, citizens and technology partners alike. As Buck and While (2017: 506, 16) put it: 'the city is not necessarily a supine patient waiting to be experimented on and rewired … in reality, the "urban" is a human ecosystem comprising protean relationships'. Despite the challenges of integrating urbanisms of the past, present and future, many of the testbeds for models of smart technology are inchoate cities that reflect many of the shortcomings of the smart urbanism paradigm, not least the scientific approach to urban development.

Around the world, 'living laboratories' have been built from scratch to develop, test and refine the technologies needed to realise smart forms of urbanism. Developments like Songdo in South Korea, Masdar in the UAE and PlanIT Valley in Portugal provide 'idealised visions of possible futures, while avoiding the messy realities of established cities' (Kitchin, 2015: 133; Halpern et al., 2014). The exceptional circumstances surrounding these developments has resulted in closer interrogation of the disconnect between such visionary projects and the realities of urban environments. Such developments avoid integrating with pre-existing urban forms, and are divorced from the social, political and cultural milieus within which the technologies that they herald will be embedded. Thus, such laboratories develop technology within a socio-spatial vacuum, causing the focus to be on the technology more than on the context in which it is applied. Indeed, there is growing recognition that, when applied to established urban environments, the passivity of such milieus quickly falls away, and the agency of space and time starts to 'complicate, enable, disrupt, resist, and translate SU [smart urbanism]' (Luque-Ayala and Marvin, 2015: 2108). The relationship between smart technologies and urban environments is therefore recursive, with each serving to transform the other.

Having identified some of the key promises and premises that underpin discourses of smart urbanism, we now apply these learnings to Singapore. An applied understanding of the opportunities and challenges of smart urbanism is needed, as the discourse currently lacks 'critical reflection on the wider implications of technologically rooted entrepreneurial urban development, or the consequences of networked urbanism, for city administrators and citizens' (Kitchin, 2015: 132; see also Barns et al., 2017; Buck and While, 2017; Farías and Blok, 2016). Our interpretation of the Singapore case interrogates the workings of smart urbanism in the real world, and the associated issues of surveillance and 'dataveillance', technocratic governance, technological rigidity, social taxonomies, digital divisions, inclusion, and so on. Being both an island city-state and a city of global standing renders the Singapore case instructive to the discourse,

not least because such characteristics coalesce to create a unique situation of effective governance, technological progress, limited socio-spatial inequality, and a legacy of ongoing urban renewal.

## The praxis of smart urbanismin Singapore

Since the formulation of the first national IT masterplan in 1980, Singapore has repeatedly reinvented its approach to urban planning and governance in order to stay abreast of developments in technology. IT development began in 1981, causing Singapore to be one of the first cities to embrace the rhetoric of 'intelligence' into its urban imaginarium (see Olds and Yeung, 2004); its track record of successful urban transformation has since seen it export many of its practices in urban planning, governance and design to other cities in Asia and beyond (Woods and Kong, 2017). The need for ongoing urban transformation in Singapore is real; as an 'ultra-dense city-state, effective and innovative urban development is a social and economic imperative [that is] intricately intertwined with Singapore's competitiveness and quality of life' (Foo and Pan, 2016: 77). Much of Singapore's political validation stems from its economic competitiveness, and unprecedented development trajectory in the 50 years since independence. Singapore's economic success validates the forms of (top-down) governance that gave rise to such success, which in turn serves to reproduce the power of the state in determining the country's development trajectory. Accordingly, smart urbanism has been recognised as the model that will enable Singapore's future-readiness (what Ho, 2017b, terms a 'neoliberalism-as-developmental strategy'), and has been aggressively pursued by the government through its 'Smart Nation' initiative.

The initiative is the latest of a series of technology-enabled initiatives that have underpinned Singapore's urban policy since the 1980s. Since the formulation of the first IT masterplan in 1980, Singapore has sought to realise its ambition of becoming a smart city. Unlike many of its counterparts, therefore, Singapore has a relatively long and organic history of national ICT (information and communications technology) planning. The inaugural masterplan of 1980 focused on computerising government agencies, which subsequently expanded to the private sector, and, more recently to enhancing connectivity to its residents islandwide (Foo and Pan, 2016). In 1999, the formation of the Infocomm Development Authority (IDA) led the expansion of Singapore's digital infrastructure. Accordingly, 4G networks now cover 99% of the island, mobile phone penetration is almost 150% of the population of 5.5 million, and there are 1.1 million fibre broadband subscriptions (The Sunday Times, 2016). Beyond the upgrading and expansion of ICT infrastructure, the IDA also spearheaded the Intelligent Nation 2015 (iN2015) masterplan, which set out a 10-year strategy to further expand Singapore's ICT capabilities. In 2016, to reflect the ever-growing role of digital technology in the governance of Singapore, IDA was restructured to comprise two separate entities: the Info-communications Media Development Authority (IMDA) and Government Tech-nology Agency (GovTech). Whilst IMDA promotes the development and convergence of, and also regulates, the infocomm and media sectors, GovTech drives the digital transformation of government services and the rollout of digital infrastructures and applications. As a key part of the iN2015 masterplan, the Smart Nation initiative is Singapore's public-facing vision of its future.

The launch of the Smart Nation initiative in November 2014 heralded the next era of urban transformation for the city-state. Singapore's approach to being a Smart Nation is based on 'its ability to gather data, interpret it, glean insights and then translate those insights into meaningful action' (Foo and Pan, 2016: 78). It focuses on five key domains – transport, home and environment, business productivity, health and enabled ageing, and public-sector services – within each of which the government seeks to co-create solutions with both citizens and businesses. In 2016, Juniper Research named Singapore 'Global Smart City – 2016' in recognition of the developments it had made in enhancing mobility, the penetration of

digital technologies, the delivery of public-sector services and open data.3 Such recognition reflects the three 'enablers' that have been developed by the government to catalyse the development of solutions (Smart Nation Singapore, 2017). The first relates to facilitating smart solutions, through the development of testbeds that enable ideas to be prototyped in real-world environments before being rolled out on a larger scale. Changi General Hospital, for example, is home to the Centre for Healthcare Assistive and Robotics Technology (CHART) to enable the development of solutions between academia, industry and research institutions. Also, a smart township called Jurong Lake District has been developed in the west of Singapore by the Housing Development Board (HDB) to serve as a testbed for smart applications that will eventually be implemented island-wide (Foo and Pan, 2016).

The second relates to the nurturing of a culture of experimentation and sustaining innovation. This is done in five ways: (1) open data and connectivity; (2) investment in research and development; (3) living laboratory; (4) industry and start-up ecosystem; and (5) cybersecurity and data privacy. Open data (#1) has been enabled through the Smart Nation Sensor Platform (SNSP), which involved the installation of 1000 sensors throughout the island in late 2014 to gather data pertaining to air quality, water levels and public safety, and the formation of DataSpark. DataSpark is a collaboration with Singapore's largest (and state-owned) telco, Singtel, to collect, analyse and model big data relating to tourism, retail marketing, public transportation and other such services. Like the development of 'testbeds' in Changi General Hospital and Jurong Lake District, the idea of a living laboratory (#3) has seen parts of the island become spaces for the incubation of new technological prototypes. For example, one-north – a business park for R&D into biomedical and infocomm technologies – has become a test site for self-driving vehicles and other mobility concepts.

Finally, the third enabler relates to the building of computational capabilities amongst the general population. This ranges from the IMDA's Playmaker Programme (which exposes young children to technology) to the Code@SG movement (which involves teaching schoolchildren coding skills) and ICT skills upgrading programmes such as SkillsFuture that are designed for the workforce (Smart Nation Singapore, 2017). Combined, these initiatives aim to provide a holistic framework to maximise the effectiveness and inclusiveness of the Smart Nation initiative. Figure 1 provides a chronology of key milestones in the evolution of Singapore's Smart Nation initiative, from its launch in November 2014 to mid-2017.

| Year | | Milestone |
|---|---|---|
| 2014 | November | • Launch of the Smart Nation initiative by Prime Minister Lee Hsien Loong<br>• Smart Nation Programme Office established |
| 2015 | April | • PM Lee Hsien Loong outlined the priorities of Smart Nation<br>• The Land Transport Authority (LTA) released more transport-related datasets via its revamped *DataMall* portal |
| | July | • Opening of the Centre for Healthcare Assistive and Robotics Technology (CHART) at Changi General Hospital<br>• Announcement of the Smart Yuhua pilot, part of the Jurong Lake District township<br>• Launch of the government's revamped open data portal – *data.gov.sg* |
| | September | • Announcement of the *Playmaker Programme* |
| | October | • *Wireless@SG* – a free public Wifi network – introduced in 33 train stations around the island<br>• Launch of *HealthHub* – a one-stop portal and app for Singaporeans to access their family's health records |
| 2016 | February | • Announcement of a new Cyber Security Bill (to be launched end-2016) to strengthen cybersecurity |
| | March | • Launch of the Smart Nation Fellowship Programme to foster tech talents to collaborate with the government to deliver projects |
| | April | • Launch of My Smart HDB Home @ Yuhua, causing smart home solutions to be extended to more residents<br>• *Wireless@SG* surfing speeds increased from 2Mbps to 5Mbps<br>• Expansion of the Code@SG programme from 22,000 to 24,000 students per year |
| | October | • Launch of the Government Technology Agency of Singapore (GovTech) and the Info-communications Media Development Authority (IMDA) to support the Smart Nation initiative |
| 2017 | January | • LTA and GovTech announce plans to develop intelligent, energy-efficient lighting systems for public roads by 2022 |
| | May | • Formation of the Smart Nation and Digital Government Office (SNDGO) under the Prime Minister's Office (PMO) to accelerate the development of the Smart Nation initiative |

Figure 1. Timeline showing the key projects and milestones of Singapore's Smart Nation initiative, 2014–2017

Source: adapted from Smart Nation Singapore (2017).

A fourth enabler, not explicitly identified by the government but nonetheless integral to the development of the Smart Nation, is public–private (and, indeed, public–public) collaborations with global technology firms and local universities. In spearheading the Smart Urban Habitat aspect of the Smart Nation initiative, the HDB is partnering with engineering firms Aecom, Arup and Samsung to develop a digital master plan and Smart Hub – a repository for data and analytics regarding Singapore's residential environment. Tertiary education institutions are also playing a prominent role in incubating various Smart Nation initiatives. Specifically, the National University of Singapore established a dedicated Smart Nation research cluster in 2016 to develop new capabilities in data science, analytics and cybersecurity. Likewise, Singapore Management University has partnered with Tata Consultancy Services to create an iCity Lab that focuses on developing IT solutions to enable more efficient private- and public-sector management. A landmark project is SHINESeniors, which is developing a range of senior-specific home-based technology solutions (notably, movement-tracking sensors, panic buttons and sensor-activated medicine boxes) to facilitate 'ageing-in-place'. Complementing these strategic research thrusts, SMU recently launched a new undergraduate major in Smart-City Management and Technology to help train the next generation of urban leaders.

Whilst many of the projects associated with the Smart Nation initiative are still at the planning, development or trial stages, their growing presence in local media and public discourse has already started to reveal some of the challenges associated with their application. The next section highlights a series of paradoxes that are at play in Singapore, but which apply to projects of smart urbanism more generally.

## The paradoxes of smart urbanism in Singapore

Projects of smart urbanism – no matter where they are implemented, or how aligned their stakeholders are – are plagued by paradoxes. As alluded to above, these often stem from the inherent tension between 'smart' and 'urbanism'; or, between something abstract and something real, between technology and society, between global capital and local citizens, between top-down development and bottom-up participation (see Hollands, 2008). That said, given the widespread uptake of models of smart urbanism, coupled with the potential of such technologies to bring about genuine forms of betterment, it is apparent that there are few foreseeable, more compelling, less challenging alternatives to a 'smart' future, whatever form it may take. Accordingly, it is worth acknowledging such paradoxes, with a view to working through them. Below we address four paradoxes – ideology/praxis, efficiency/control, access/choice, and smart governance/smart citizenship – by examining them in both conceptual terms, and in terms of their application to Singapore.

### *Ideology and praxis*

The promises of smart urbanism are tremendous; the problem lies in living up to them. In reality, therefore, the praxis of smart urbanism is often uneven or inequitable in its impact – it is sporadic, messy, and highly variable in its ability to bring about greater efficiency or change (Shelton et al., 2015). The technologies of smart urbanism are imposed on society and space, which means that the extent to which they are (mis)used, (mis)understood and (mis)applied depends as much on the user as it does the technology itself. As such, one of the key challenges facing urban planners is to prove that smart technology can bring about tangible benefits. Despite having been launched more than two years ago, Singapore's Prime Minister Lee Hsien Loong recently admitted that tangible results from the Smart Nation initiative are still lacking (The Straits Times, 2017). This highlights the difficulties in implementing smart technologies (and integrating them with legacy systems), reveals the shortened timeframe within which the impact of smart urbanism is expected to be felt, and emphasises the need for greater co-ordination between (and integration amongst) government agencies to ensure the success of such initiatives. An example of the hindering effect of legacy systems is the stalled rollout of the Mobile Digital ID – which will enable residents to conduct 'high-stakes online exchanges' such as e-prescriptions, e-voting, e-payments and an e-court – to replace the existing SingPass system,4 which was established in 2003 (Tham, 2016: 78). Substituting systems is a more complex process than establishing one from scratch, a barrier that has caused Singapore to lag behind early adopters of nationwide digital IDs such as Estonia and Hong Kong.

More insidious, however, is the view that effective smart urbanism provides tangible benefits at the expense of civic freedoms. The ideology of smart urbanism is based on the notion of technocratic governance, which can 'threaten to stifle rights to privacy, confidentiality, and freedom of expression' (Kitchin, 2014: 12; see also Foucault, 1977; Hatuka and Toch, 2017). Singapore is renowned for its effective forms of governance, which some already view as autocratic (see Chua, 2011; Shatkin, 2014) and there is clearly scope for smart technology to further (and justify) such hegemony in the name of

urban progress and development. Indeed, the Smart Nation discourse follows a similar pattern. The need to implement Smart Nation initiatives is validated by a series of threats that Singapore faces – such as falling birth rate and an ageing population, the challenges of sustaining its levels of economic competitiveness, and resource scarcity – which underscore the ideology of smart urbanism. Smart infrastructures will lead to greater automation and, therefore, less reliance on a declining (and, increasingly, ageing) workforce. They will also spearhead economic development (by growing the emerging digital economy associated with FinTech, HealthTech and media production, for example) and enable greater resource efficiency.

These threats underpin the emotive nature of the discourse, and the need for it to be a success. They are also, however, top-down narratives that privilege the interests of the country over those of the individual. The assumption is that individual interests are aligned with those of the country, and that the praxis of smart urbanism is justified by the ideology. Where the interests of the individual are misaligned with those of the country, they can, however, undermine the legitimacy and progress of smart urbanism. This can cause the implementation and utility of smart technologies to be limited by their lack of resonance in – and value to – the lives of their users. Reconciling the gulf between ideology and praxis will, therefore, bring about new ways of envisioning and navigating the real world in ways that are enabled by the digital domain.

### *Efficiency and control*

Smart cities are controlled cities: they are disciplined and efficient. Efficiencies can help to save time and resources, with some solutions (such as e-payments) empowering consumers to be more autonomous and less reliant on physical infrastructures (such as the bank branch). Embedding technologies within urban infrastructures also enables the city to be 'monitored, managed and regulated in real-time' (Kitchin, 2015: 131), and, therefore, to be controlled. Thus, whilst a smart city helps to control the provision of services, by extension, it also involves control over the populace. This brings about what Hatuka and Toch (2017: 986) term 'asymmetrical visibility' whereby data are collected, stored, analysed and interpreted as a form of public right rather than personal freedom. In itself, this reflects the imbalance between owners and managers of digital infrastructures, and their users. Such an imbalance has been criticised for concealing the growing securitisation of urban environments through the ongoing collection and monitoring of data, or 'dataveillance' (Aradau, 2015; Leszczynski, 2016).

In Singapore, elderly citizens have already been shown to resist smart technology in the home, despite having the potential to use a more cost-efficient form of eldercare. A 'smart home' trial was conducted in Yuhua – an HDB estate in the Jurong Lake District – and involved the installation of sensors on doors to monitor the (in)activity of elderly residents. Many of those involved in the trial disliked being (mis)represented as vulnerable and useless, and also resisted the loss of privacy associated with surveillance. In response, some resorted to covering the sensors with towels (The Straits Times, 2017). Moreover, in-progress research amongst the elderly triallists of the SHINESeniors project introduced above suggests that smart eldercare can evoke a range of responses, from greater confidence and safety, to apathy, ridicule and fear. Technology is often (perceived to be) anathema to the elderly, and preliminary interview findings suggest that smart eldercare still struggles to bring about positive change to the lives of its beneficiaries. Specifically, panic buttons (which are meant to be pressed during emergencies) are often kept out of the way, meaning that at times when they are required (after a fall, for instance), they are not easily accessible. This nullifies their use, causing triallists to respond to falls as they normally would (by using their phones to call for help, or, more often, to just shout until they are heard by their neighbours).

Conversely, the social workers receiving notifications about the activation of a panic button or periods of inactivity picked up by the in-home sensors recalled the stresses of having to be 'always on', and always responsive to the data being relayed to them (even during their time off).

These reactions raise questions that go beyond the utility of smart technologies, and concern the assumptions that underpin smart urbanism. On the one hand, smart urbanism involves the active and compliant participation of citizens (see McLean et al., 2016; Vanolo, 2014). On the other, failure, or a lack of willingness to participate, can bring about new forms of marginalisation and exclusion. Reconciliation of these two standpoints is needed to ensure both the optimal usage of smart technologies, and equitable access to their (positive) effects. Without such reconciliation, projects of smart urbanism run the inherent risk of being limited by the lack of uptake and (mis)use of smart technologies. The risk, therefore, is that the apathy and agency of (potential) users can result in behaviours that manifest as the avoidance of smart technologies.

### *Access and choice*

Smart urbanism only works if its key beneficiaries – the inhabitants of a city – choose to engage with the enablers of a smart lifestyle. Such engagement ranges from the general (such as being open to change), to the more specific (such as being willing to surrender private data and to adopt new habits of living). Indeed, whilst technology has been 'eulogized as a kind of equalizer if not a "great leveller" of our times' (Vuolteenaho et al., 2015: 9), its empowering potential is predicated on digital access, ownership and literacy, with there being 'little room for the technologically illiterate' (Vanolo, 2014: 893; e.g. Reitzes et al., 2016). Thus, whilst access is the prerogative of governments to make digital technologies – both in terms of hardware (devices, or access to devices, and broadband connectivity) and software (training and education) – available to all, it is the choice of the individual how much they engage with them (Wiig and Wyly, 2016). An effective smart city is predicated on widespread access and high degrees of engagement. Often, however, this is not the case.

In Singapore, there have been various attempts to increase access and promote engagement, ranging from supportive measures (such as the upskilling and reskilling of workers – initiatives that have so far been criticised for their lack of demonstrable impact – see The Straits Times, 2017) to more thinly veiled forms of coercion. For example, in a bid to encourage digital engagement, the government recently abolished 2G mobile networks (popular amongst marginal groups, such as the elderly, lower income families, and low-paid migrant workers), forcing them to upgrade their phones and cross (and therefore reduce) the digital divide. Such a move can be viewed as a not-so-subtle form of coercion that undermines the free choice of the population. Similarly, a proposed solution to encourage uptake and usage of smart monitoring and healthcare solutions amongst the elderly has been to offer their children income tax relief in return for persuading their parents to comply (The Straits Times, 2017), and, by extension, their children as well. For the less well-off for whom such income tax relief is a welcome relief, it is nevertheless a subtle push to adopt technology void of choice and volition. Such practices can cause the real value of smart technologies to be obfuscated by the layers of incentives that are used to drive uptake and encourage usage. In turn, such practices can create an unsustainable form of value realisation that runs the real risk of smart technologies being undermined by the reduced volition involved in their uptake.

***Smart governance and smart citizenship***

The three paradoxes outlined above would, perhaps, be significantly ameliorated if 'smart governance' worked in harmony with a population of 'smart citizens'. Whilst each category is by no means absolute, the realisation of each would presuppose a strong degree of alignment between each stakeholder group, which would, as a result, minimise the politics embedded within the discourse. The fact that nowhere in the world is either category fully (or even partially) realised, underscores the importance of this final pairing, and the long and transformative shift in mindsets and lifestyles that is needed to bring about its resolution. Indeed, it has been suggested that in a smart environment, 'power no longer resides in the modern institutions of representative democracy and the market economy; instead, power has become a matter of logistics, infrastructures and expertise' (Farías and Blok, 2016: 539). The destabilisation of traditional structures of power and governance by media organisations such as WikiLeaks and hacking collectives such as Anonymous reveals how power is increasingly being transferred to those with the ability to access, exploit and disseminate data for their own purposes. This underscores the importance of such a transformation, and reveals the radically disruptive role of technology in defining urban futures. Yet, whilst technology may be the enabler of smart urbanism, both smart governance and smart citizens are needed to realise its full potential.

The reality is that smart cities do not just need smart governance, they need smart governments as well. This has radical implications for the ways that both cities, and nation-states, are managed and developed, and presents a political challenge that governments around the world are grappling to come to terms with (after Foucault, 1991; Ho, 2017a). For many decades, Singapore's government has promoted an agenda of technological advancement; more recently, and in response to the unique nature and challenges of smart urbanism, this has involved significant restructuring. Given the need for strong public-sector alignment and integration (and reflecting the fact that there has so far been little evidence of such co-operativeness), both GovTech (introduced above) and the Smart Nation and Digital Government Office (SNDGO – a working group comprising staff from the Ministry of Finance, the Ministry of Communications and Information, and the Smart Nation Programme Office) have recently been centralised to sit within the Prime Minister's Office. In doing so, the aim is to speed up Singapore's digital transformation by creating a government structure that is more aligned with the demands of a Smart Nation, and, perhaps more importantly, to drive not just the development but also the effective implementation and uptake of smart technologies (GovTech, 2017).

A smart city needs to be enlivened and enacted by smart citizens (Ho, 2017b; Kitchin, 2014), a new and unique 'type' of citizenship that is constructed and imposed by the state, from 'above'. Smart citizens need to be trained in digital technologies, they need to be upskilled to work in digitally enabled companies and organisations, and, perhaps most critically, they need to see the value of doing so. Whilst early adopters of technology and 'digital natives' (i.e. those born around the year 2000, who have not known a pre-digital world) will be ahead of the curve, marginal groups such as the elderly or socio-economically marginalised will be behind, creating new forms of social division and inequality. In this vein, whilst smart citizenship has been treated as an outcome of successful smart governance (see Vanolo, 2014), it is an inherently problematic category for governments. On the one hand, whilst 'citizenship' is an inclusive form of categorisation, 'smartness' is potentially or even inherently divisive, meaning the notion of 'smart citizenship' has the potential to create social division as much as it can overcome them. Specifically, those that fall outside – whether by choice or circumstance – of the competencies and characteristics of a smart citizen are, by definition, '"dumb" and unintelligent, non-conversant and incomprehensible to the network' (McLean et al., 2016: 3252; also, Andrejevic, 2005; Graham and

Marvin, 2001). This can have potentially severe ramifications for socio-spatial integration, and a sense of national belonging.

On the other hand, smart citizens are, by definition, emancipated citizens that can, and should, have the power to influence urban strategies and political outcomes (see AlSayyad and Guvenc, 2015). Smart citizens have the potential to exist on terms of relative parity with smart governments; power becomes devolved from governments to systems and, as such, governance becomes more participatory. Whilst Singapore proclaims that 'the smart city is not just for citizens – it is also created by citizens' (Heng, 2016: 11), and recognises that 'empowerment is key … too much top-down control will kill the spirit of innovation that is central to a Smart Nation' (Ho, 2017a), the extent to which the government is willing to relinquish power by enabling access to data that could potentially be sensitive (by, for example, highlighting ethno-cultural or socio-economic divisions) remains to be seen. More than that, however, is the assumed willingness of citizens to participate in the socio-technical 'upgrading' that comes with smart citizenship. Our research amongst triallists of the SHINESeniors project has started to show that the elderly value the human interaction that comes with the technology (that is, the installation and upgrading of the sensors, the in-home check-ins amongst social workers involved in the project, and the interactions with SMU staff) more than they do the technology itself. Similarly, the recent phasing out of 2G networks in Singapore has necessitated the upgrading of mobile handsets amongst the elderly, with many now owning 'smart' phones but using them in a 'dumb' way. Interviews revealed how the smart phones that the elderly were forced to upgrade to were mostly used for making and receiving calls only; a few were able to send text messages, and only a small handful could use messaging (or any other) apps. This raises a host of questions surrounding not just the (perceived) diminution of human contact associated with technology, but also the changing terms of contact; changes that relate to the provision of eldercare as much as they do the changing terms of inter-personal communication (the emotional distance of sending a typed message to someone instead of calling them, for example). Amongst the elderly, therefore, participation in projects of smart urbanism may be less about realising the functional benefits of technology, and more about trying to maximise – or at least not to lose – the emotional benefits of human interaction.

Whilst smart urbanism remains mired in the politics of paradox, the discourse continues to advance towards an idealised vision of the urban future. Such a vision is richer than the marketing rhetoric articulated in the promises of smart urbanism above suggests, and reflects 'new ways of imagining, organising and managing the city and its flows' (Vanolo, 2014: 883; see also McFarlane, 2016). This vision finds meaning in the heuristic of 'fourthspace' – digitally enabled urban spaces that are co-created by governments, citizens and the private sector that are built on an expanded and diffuse notion of civic responsibility. An extension of Soja's (1996) notion of 'thirdspace', fourthspace recognises the significant destabilisation and (re)configurations of power brought about by digital technology. Soja (1996; see also Soja, 1999) identifies firstspace as the material manifestations of everyday life – an objective geographical mapping of 'things in space'; secondspace as the symbolic, ideologic and epistemologic representations of space – a more subjective geographical imagination of 'thoughts about space'; and thirdspace as a postmodern interpretation of lived space wherein definitions are not imposed, but are both material and symbolic, real and imagined. Whilst our conceptualisation of fourthspace builds on the same emancipatory sense of 'openness' as thirdspace, it does so by reframing it as the intersection of the digital, real and imagined worlds. In doing so, it recognises the fact that digital technologies are playing an increasingly prominent role in expanding the purview of spatial theory, and, with such prominence, enabling new ways of engaging with, and experiencing, space. As smart urbanism accelerates the expansion of fourthspace into ever more walks of life, the importance of fourthspace as a discursive lens through which urban processes can be analysed and understood becomes apparent.

Indeed, as ‘smartness’ becomes more entrenched in urban environments, we expect the role of fourthspace as a discursive lens to adapt as well. Specifically, until the various players that are implicated in smart urban ecosystems are ready to fulfil their respective roles – i.e. until governments and citizens become ‘smarter’, and more aligned with the private sector – the ideal of fourthspace serves to (re)produce the tensions outlined above. It reflects back the teething problems that come with learning, growth and transformation. However, once a certain standard of smart urbanism has been achieved, fourthspace shifts from being a mirror that reflects faults and problems, to one that enables radically different, and emancipatory, urban futures (see Purcell, 2017).

## Fourthspace: Decolonising the city, determining urban futures

In this final section, we present the framework of fourthspace, which can be used to imagine and define the new spatial imagination brought to fruition through smart urbanism. Whilst existing interpretations of fourthspace have associated it with a more affective and embodied experience of space (Thrift, 2009), or with the repeal of the liberation of thirdspace and associated degeneration to violence (Giles, 2006), our framework focuses on the emancipatory potential that comes with digital transformation and the subsequent ‘decolonisation’ of the city through processes of digital transformation. In this sense, our contribution is more aligned with Thrift’s (2009) articulation of fourthspace as an extension of thirdspace. In his case, this involves adding the affective experience of space to the real and imagined experiences of space outlined by Soja, through a focus on the ‘particular rhythms of being that confirm and naturalize the existence of certain spaces’ (Thrift, 2009: 95). Whilst we do not discount Thrift’s extension, our notion of fourthspace involves expanding the treatment of space itself. In doing so, we recognise and embrace the inevitable encroachment of digital technologies into the structuring, ordering, and experience of, and engagement with, space. In turn, given that such encroachment implicates the real, imagined and affective experience of space, our contribution should be viewed not just as an extension of thirdspace, but a novel reinterpretation of space within a framework of digital transformation.

Our understanding of fourthspace is important and timely. It recognises that the ways in which different stakeholders engage with the city are changing, and that such changes are bringing about new spatial forms and imaginations, and creating new opportunities for decolonised forms of knowledge production (Radcliffe, 2017). Importantly, our framework of fourthspace also helps to reveal how smart urbanism can lead to a recolonisation of the city by creating new possibilities for control (Deleuze, 1992), the discipline of both self and other (Foucault, 1977), post-human agency (Rose, 2017) and power that is ‘exerted subtly through distributed protocols that define and regulate access to resources and spaces and reshape behaviour’ (Ash et al., 2016: 7). As such, it can be used to help anticipate and manage the process of transformation brought about by smart urbanism, and to bring about a level of ideological alignment amongst its constituent stakeholders. In what follows, we identify and explicate three defining pillars of fourthspace: digital space, data are/and power, and participatory governance. These pillars aim to reconcile the paradoxes previously outlined. Thus, digital space speaks to ideology and praxis; data are/and power speaks to efficiency and control, and access and choice; and participatory governance speaks to access and choice and smart governance and smart citizenship.

### *Digital space*

Perhaps the biggest force disrupting the contemporary world is the encroachment of digital technologies into an increasing number and variety of walks of life, especially those located within urban environments. Indeed, smart urbanism is defined by digital technology. Exactly two decades ago it was predicted that 'the same computer we deploy to understand our cities has become a new type of city … the tools we made eventually will make us' (Sui, 1997: 84, 85). This sentiment rings true today, and will only take on more meaning in the years to come. With this in mind, fourthspace provides a framework to understand the role of digital technologies in shaping and mediating the experience of space and spatiality, and, in turn, how such technologies 'come to enact progressively routine orderings of quotidian rhythms, interactions, opportunities, spatial configurations, and flows' (Ash et al., 2016: 2; after Franklin, 2015). Put differently, fourthspace reflects a new blend of everyday spaces that merges the digital with the analogue, the online with the offline, and the public with the private. Based on the assumption of digital enablement, fourthspace recognises that fact that digital and physical spaces are increasingly co-constitutive, with each enabling the other. Thus, whilst mobile traffic apps can help drivers to navigate the fastest way from point to point, the fact that they use the app means that their movement will also be tracked, causing them to become a datapoint that will, in turn, influence other app users. In this sense, the spaces we inhabit will, increasingly, no longer be purely of either the one domain or the other, but will be augmented through mutual dependence.

The categories that previously played a normative role in classifying and understanding space become merged and invalidated in a world where digital technologies play a dominant role in social ordering and the construction and contestation of power. Such technologies help to create an 'intangible territorial layer made of ephemeral appropriations of space with various levels of interconnection, systemisation and complexity' (Firmino and Duarte, 2016: 742). The blending that comes from such interconnections is reflected in studies that show how individuals often assume that virtual (or digital) space is more public than private (e.g. Hatuka and Toch (2017) show how the loss of privacy in public spaces has caused the sharing of private data to become normalised), and the nascent role of virtual reality in marketing, education, engineering, design, social interaction and cultural reproduction. Existing labels of spatial ordering are being emptied of meaning in a digitally defined world. Public places have become sites of private (digital) media consumption, whilst ostensibly private information is increasingly shared publicly through the use of social media. Altogether, this underscores the need for new ways to interpret and imagine urban space, as existing distinctions between public and private become subsumed within a more integrated understanding of behaviours that are at once public and private. Digital space mediates such behaviours, and plays an important – yet hitherto unexplored – role in forging new forms of classification and ordering.

### *Data are/and power*

Commensurate with the encroachment of digital technologies is the production of unprecedented volumes of data – the abovementioned 'lifeblood' of smart urbanism. The (in)ability to comprehend and deploy such data correlates with the new geometries of power embedded within smart urbanism. Ironically, despite the problems associated with technocratic forms of governance, the unwieldy nature of governments (and the public sector more generally) underpins the emancipatory role of digital data in disrupting pre-existing structures of urban power. As Farías and Blok (2016) recognise, the nature of power in urban environments has changed dramatically in the face of 'technical democracy' – from being wielded by extra-governmental collectives (such as hackers and app developers), to being embedded

within infrastructures. In Singapore, selected government data are being made available to private app developers in recognition of the fact that digital futures are underpinned by more horizontal processes of co-creation, rather than the top-down design and implementation of public services (Heng, 2016). This partial democratisation of data reflects both an important first step towards relinquishing control of the public domain, and the fact that such relinquishment is a necessary concession that underpins the integrity of smart urbanism. Data are a new form of agency, meaning power – and associated 'rights to the city' – rests with those that are able to access and interpret it in ways that can evoke change – both positive, and negative (after Lefebvre, 1968; Purcell, 2017).

Digital space has led to the creation of new power structures and symmetries that differ radically from their traditional forebears. The rise of hacking collectives – and the employment of professional hackers within corporations and government agencies – reflects the fact that the digital realm has resulted in such reordering. The cultures of bottom-up programming and hacking have redefined the possibility for ownership of the city, creating opportunities for subversion to become normative (Farías and Blok, 2016; see also Ho, 2017b), in what might be considered processes of decolonisation and democratisation. Thus, whilst power is increasingly entwined with the 'product of discursive tactics of professionals who use scientific surveillance techniques to normalise social behaviour' (Vanolo, 2014: 885; e.g. Spiller, 2016), within fourthspace, such processes of normalisation can work not just both ways (i.e. between 'professionals' and 'society'), but in any way (i.e. between any and all stakeholders that meet the qualifying crieria of access and interpretation). Thus, contrary to a situation of post-politics wherein the urban becomes a commoditised and algorithmically defined category (after Dodge and Kitchin, 2005; Swynegdouw, 2007), fourthspace destabilises normative power structures and creates possibilities for power to become a far more equitable outcome of urban engagement, thus 'decolonising' the city. As much as these processes are already occurring in the physical domain, fourthspace can be seen to accelerate them by overcoming the implicit barriers that restrict physical forms of distribution. On the one hand, it can enable access to information and public services (especially those pertaining to healthcare and education), yet on the other it can enable inequalities and injustices to be exposed, and forms of protest to foment. Fourthspace is an outcome of the democratisation of information; just as the exposure of injustice and inequality increases, so too does the potential to overcome such socio-spatial forms of segregation.

### *Participatory governance*

When implemented for the benefit of all, digital technologies and the data they produce can lead to co-constructed urban spaces and, ultimately, more participatory – or decolonised – forms of urban governance. Thus, whilst smart urbanism has been criticised for providing a 'powerful tool for the production of docile subjects and mechanisms of political manipulation' (Vanolo, 2014: 883), fourthspace recognises the emancipatory potential of digital technologies, and correlates political power and governance with the degree of voluntary engagement with the project of urban inclusiveness. This is recognised in Singapore, where Prime Minister Lee Hsien Loong noted in 2014 that, whilst the government was responsible for creating a 'smart' framework and infrastructure for citizens to contribute to, 'the participation of the whole nation is vital to make Singapore an outstanding city in the world to live, work and play' (cited in Housing and Development Board, 2016). Indeed, whilst it is easy to treat the aggressive promotion of projects of smart urbanism by governments and corporations in a cynical light, such projects are risky because there is a lack of clarity around what the outcomes may be, not because of what they will be. As discussed above in relation to smart eldercare in Singapore, the gap between technology in its abstract and applied forms reveals the range of outcomes that can result from technological interventions – some desired, others not. Despite the marketing spiel, smart urbanism

provides an opportunity for more bottom-up, participatory forms of governance that can disrupt and redefine the normative viewpoint from which such cynicism stems. In Singapore, this involves a 'reconfiguring of the boundaries and modes of citizen participation in line with the ethos of participation and empowerment of smart urbanism' (Ho, 2017b: 3110). Whilst it is not yet clear how such processes of 'reconfiguration' will be enacted by the stakeholders involved, nor the effects, the 'ethos of participation' is a key determinant that underpins the success or failure of any project of smart urbanism.

As digital technologies continue to disrupt and shift or remove the boundaries that encompass traditional categories of power, society and space, more transgressive understandings take their place. The socio-political ramifications of this are huge, and extend not just to vertical forms of governance (i.e. governors-governed), but to horizontal forms as well (i.e. within and between social groups). Households, for example, are encouraged to become inter-connected webs of mutually supportive actors and are discouraged from being isolated units that operate independently of each other. Civic responsibility takes on a meaning that expands beyond an individual's family, home or environment, as the inter-connectedness of individuals encourages them to become more mutually accountable for their surroundings. In Singapore, littering can now be reported in real-time through an app developed by the National Environment Agency, whilst utilities provider Singapore Power encourages households to take charge of their utilities expenditure by reading their own meters and uploading their scores using an app. Importantly, to prevent further marginalisation of communities that exist mostly outside of the digital fold, recognition is needed of the different and variable roles that different social segments (can) play in order to bring about an inclusivist form of participatory governance. Whilst marginal segments may never be direct influencers, it is important that they are integrated into the webs and spaces of social influence from which new forms of governance may stem. This can be done by first identifying who they are (a form of smart citizen segmentation) and then actively removing the barriers to accessing and using technology in order to demonstrate its potential to complement existing lifestyle. With this in mind, fourthspace represents an expansion of civic horizons, and a redefined role of citizens as active stakeholders in the urban enterprise.

## Conclusions

Smart urbanism cannot be avoided. In its abstract form, it is a discursive construct that will morph over time and space; in its applied form, it is an urban response to the digital era. Paradoxically, however, whilst the applied form is what makes smart urbanism so potentially transformational, scholarship has so far focused on the theoretical. By critically interrogating Singapore's Smart Nation initiative, this paper has attempted to bridge the gap between smart urbanism in its applied and abstract forms. Specifically, it has identified three premises – (1) data-driven feedback loops; (2) effective public–(public–)private partnerships; and (3) integrating urbanisms of past, present and future – that practitioners must negotiate when implementing any smart solution. It has also used the Singapore case to identify and expound four paradoxes that must be negotiated to prevent any smart urbanism initiative from being undermined. These are: (1) ideology and praxis; (2) efficiency and control; (3) access and choice; and (4) smart governance and smart citizenship. Finally, it has advanced the concept of 'fourthspace' to demonstrate how urban futures will increasingly be informed by the principles of digital space, data are/and power, and participatory governance. Altogether, this paper offers an integrated framework for identifying, anticipating and overcoming the challenges posed by smart urbanism.

That said, learnings from systems and complexity theory highlight the fact that in order to fully understand the opportunities and challenges presented by digital infrastructures, there is a need to unravel the relationships that bridge ideology and praxis, technology and society, the 'smart' and the 'urban' through a more sustained empirical focus on the application of smart technologies (Vaast and Walsham, 2009). Without descent to case study, there can be no grounded ascent to theory. To this point, as much as research needs to focus on grounding the discourse in specific case studies and geographies, it also needs to focus on key thematic areas, such as housing, the elderly, resource management, transportation, the innovation economy, and so on. Doing so will enable a more ordered, systematic and in-depth exploration of the phenomenon of smart urbanism. The Singapore government's approach to focusing on five areas (transport, home and environment, business productivity, health and enabled ageing, and public-sector services) offers a testbed for systematic and sustained analysis in a single city of the application of smart technologies.

At present, we face a brave new (urban) world of unrealised potential. City-states such as Singapore are well-positioned to be the flag bearers for smart urbanism, as failure is not an option when a whole country's future growth and stability is invested in the project of digital transformation. Urban planners and policymakers in Singapore and beyond are coming to terms with the challenge of translating 'the attractive but elusive imaginaries of smart city discourse' into 'tangible intervention' (Buck and While, 2017: 502). The sooner this happens, the better. Until it does, the potential of smart urbanism to bring about lasting forms of betterment will remain 'unclear and contested' (Wiig and Wyly, 2016: 488). Not only that, but such a lack of clarity will continue to obfuscate the extent to which projects of smart urbanism are able to yield the utopic outcomes that are promised, or result in more dystopic outcomes that stem from the expressions of technocratic power, the curbing of civic freedoms, and the perpetuation of inequality. Fourthspace provides a framework by which the emancipatory claims of smart urbanism can be identified, embraced and assessed. Yet, whilst fourthspace provides guidance and direction, it is the processes of translating ideals into action that will ultimately determine the extent to which smart urbanism fulfils its emancipatory potential. The academy has an important role to play in managing such processes of translation, by providing technical expertise and theoretically informed, well-balanced perspectives on how digital technologies can be used to chart an equitable urban future for all.

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Notes

1. At the risk of being reductionist ourselves, this gap could reflect the broad range of disciplines that contribute to smart urbanism discourse, with the schism reflecting the differences between technology/information sciences, and the social sciences, respectively.

2. See www.stokab.se.

3. See https://www.juniperresearch.com/press/press-releases/singapore-named-global-smart-city-2016. Juniper Research provides market intelligence, consulting, data and forecasting on mobile, online and digital market developments.

4. Singpass is an online portal that is currently used to access key government services. Its replacement by Mobile Digital ID is largely due to the security vulnerabilities associated with logging in using an identity number and password; Mobile Digital ID, on the other hand, uses digital identification and authentication to conduct online exchanges in a more secure way.

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